Research Seminar

Realistic Computational Design Rendering and Synthesis

Dr Ping Li
Research Assistant Professor
Department of Computing
The Hong Kong Polytechnic University
Hong Kong

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Abstract

Computational design synthesis as an expressive way for producing user-desired appearances has received much attention in creative media researches. In interactive design, it would be powerful to render the stylized presentation of interested objects virtually using computer-aided design tools for animation effects rendering and synthesis. However, computational design for realistic detailed 2D/3D objects in real time is a challenging problem. Existing methods focused on simplifying the design effects, which unavoidably results in reducing the rich object details. In this talk, we focused the realistic computational design rendering and synthesis on photographing guidance, constructive solid geometry, and hair style animation. We present a photographing guidance for amateur photographers via deep feature retrieval and fusion. We integrate empirical aesthetic rules, traditional machine learning and deep neural networks to extract different kinds of features. We identify photo types and define matching score. A deep photographing guidance is constructed to offer professional reference photos and spatial composition suggestions. Further, we propose an efficient non-incremental method to evaluate the boundary of constructive solid geometry for triangular meshes. We designed a two-level grouping scheme to group faces sharing specific space labels to reduce redundant computation. The robustness is enhanced by plane-based geometry embedded in intersection calculation. In addition, we present a real-time hair animation of various hair styles with high fidelity details. We capture the inextensibility, bending and torsion strand mechanics, while presenting the stiction/repulsion and detailed real-time collision effects. We factorize realistic hair self-interactions into coarse, globally coupled volumetric, and detailed collision views. In the experiments, our methods consistently demonstrate high-quality performance of realistic computational design rendering and synthesis. In the future, we will further extend the design rending and synthesis to more complicated 2D/3D video applications with large motion and occluded scene. We will also work on special design effects synthesis by the inspiration of latest real-time 2D/3D graphics learning techniques.

About the Speaker

Dr Ping Li is a Research Assistant Professor at The Hong Kong Polytechnic University, who obtained his Ph.D. from The Chinese University of Hong Kong. He was an Assistant Professor at the Macau University of Science and Technology, and a Lecturer at The Education University of Hong Kong. He has 2 image/video processing national invention patents, has excellent work highlighted in IEEE MMTC Communications - Review, and has excellent project reported worldwide by ACM TechNews. Besides, he has won National Distinguished Young Expert, many Best Paper Awards, Best Presentation Award, First Prize of the U.S. mathematical contest in modeling, First Runner-Up Award in the Postgraduate Paper Contest of IEEE (HK), First Prize in Hubei Natural Sciences Outstanding Academic Paper Award, Silver Award of Asia Regional Award at Reimagine Education 2015, Highly Commended Team Award at ALT Learning Technologist of the Year Awards 2019, High-Quality Review Award at ECCV 2020, and guided the CUHK students to get the IBM Inter-University Programming Contest Champion and 2nd Runner-Up Awards (Twin Wins). He has obtained many grants in PI and Co-I capacity. He has published over 160 top-tier graphics and creative media papers (47 IEEE Transactions papers), including TVCG, TIP, TNNLS, TMI, TCSVT, TMM, TCYB, TBME, TSMC, TII, CVPR, NeurIPS, AAAI, ACM SIGGRAPH VRCAI. He has served as Chair/Co-Chair of many international conferences, as Honorary Distinguished Scientist, Techno India NJR Institute of Technology, as Expert for National Center of Science and Technology Evaluation, Ministry of Education and Science, Kazakhstan, as Keynote Speaker at IFOI 2020, and as Invited Speaker at IEEE ICCSN 2017.